Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Implementation of Section 304 of the Telecommunications Act of 1996	)	CS Docket No. 97-80
	)	
Commercial Availability of Navigation Devices	)	
	)	PP Docket No. 00-67
Compatibility Between Cable Systems and Consumer Electronics Equipment	)	

REPLY COMMENTS OF INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION

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[1] ITIF is a nonprofit, non-partisan public policy think tank committed to articulating and advancing a pro-productivity, pro-innovation and pro-technology public policy agenda internationally, in Washington and in the states. Through its research, policy proposals, and commentary, ITIF is working to advance and support public policies that boost innovation, e-transformation and productivity.

Overview

The Information Technology and Innovation Foundation (ITIF) is pleased to offer the following comments on video navigation devices. This proceeding has been an ongoing and unresolved item at the Commission's agenda for a very long time. Little progress has been in this area because the proceeding has taken a turn towards product design that appears to underappreciate the concerns of producers of licensed audio-video content, innovations in consumer product, and consumer expectations.

Enhancing consumer choice regarding video programing is a worthwhile goal. Similarly, easing the transition of broadband networks from a television orientation to an Internet orientation is an attractive and reasonable public policy goal. The FNPRM appears to emphasize creating a protected market for the personal video recorder (PVR) as it was conceived in the late 20th century, however, which doesn't advance these goals. Consequently, we offer a different vision of the navigation device that better conforms to consumer desires and avoids the many pitfalls of the classical PVR. It is our belief that the alternative vision is more consistent with the FNPRM's long range objectives.

History of the Personal Video Recorder

The familiar PVRs introduced in the late 90s were side-effects of Video-on-Demand (VoD) trials conducted by the telephone and cable companies in the mid-90s. Developers of digital video servers took the insights they gained from experimental systems into the consumer electronics realm, where it was possible to build personal systems such as the ReplayTV and TiVo which are, in effect, the "poor man's VoD."[2] Early PVRs captured television programming as an analog stream, digitized it in real time, and recorded the digital form to a hard drive at a user-selectable quality level in real time. These devices included a single analog TV tuner, and a control system that could signal channel changes to a variety of cable and satellite tuners through infrared signaling or a serial, RS-232 interface. ReplayTV used a proprietary operating system and TiVo used a version of Linux with a proprietary Media File System.

[2] The VoD trials also gave rise to DSL and DOCSIS, the cornerstone technologies of broadband networking.

The early PVRs obtained programming information by downloading a program guide from a proprietary system accessed by dial-up over the telephone network. They were sold for an initial fee plus an additional on-going service fee, ostensibly for access to the program guide. Replay TV did not charge for access to the program guide, but TiVo did. TiVo offered a lifetime (of the device) program guide for $300 over the purchase price of the device, or a monthly fee of $12.95. These devices attracted a small but dedicate cult following, but never achieved mass market success. ReplayTV sold its assets to Sonic Blue in 2001. Sonic Blue ultimately sold its assets to another firm, D & M Holdings, which has subsequently sold them to DirecTV. TiVo has remained independent, but has not generally been profitable and has steadily lost subscribers since its peak in January, 2006.[3]

Like the VCR, the early PVRs allowed consumers to time-shift their television viewing and to skip commercials, although much more easily.[4] Unlike the VCR, they also allowed consumers to view and record a given program at the same time, to pause live TV, and to view an extensive on-screen programming guide at will. The combination of these features enables a mode of television viewing in which a viewer can begin watching a baseball game 30 minutes to an hour after it starts, skip the commercials and other boring parts, and catch up with the live program stream in the ninth inning or thereabouts, for example.

TiVo also introduced the patented "Season Pass" feature that records all episodes of a series on a given channel, even when they appear at different times; the season finale of "Survivor" that appears on Sunday night is captured by a Season Pass along with the weekly installments on Thursday night, for example. The device can also search for programming using a variety of categories and keyword, and can suggest programs that the viewer may enjoy.

[3] "TiVo," in *Wikipedia*, http://en.wikipedia.org/wiki/TiVo.
[4] TiVo hides its 30 second skip feature from the mainstream user, but most readers of the Tivo Community Forum on the Internet have the back-door key sequence memorized: press "Select-Play-Select-3-0-Select" while watching recorded programming to enable the feature.

TiVo took a major step up the technology curve with the Series 1 "DirecTivo" built by Philips as the DSR-6000 in 2000. This device integrated two DirecTV tuners, which made it the first all-digital personal recording device of any kind. DirecTV broadcasts all its programming in a variation of the MPEG digital format, so the TiVo could record and replay with no loss of quality over live TV, which was not the case with first-generation PVRs. DirecTivo also obtained programming information from DirecTV's satellite downlink. DirecTV's decision to build its own high-definition PVR and break off its relationship with TiVo in 2005 proved damaging to both companies; the relationship was reinstated in late 2008.

The Series 3 TiVo line, introduced during the split with DirecTV, is the only TiVo line to incorporate Cable Card support. Current models include personalized advertising, viewers for Netflix and YouTube, access to the Amazon video store and Domino's Pizza, and access to a curated selection of Internet content; they're roughly comparable in function with the PVR's leased by MVPDs.

Current Claims

It's no secret that the retail PVR has not been a commercial success; ReplayTV is out of business, and TiVo loses money and subscribers year after year. TiVo asserts that their lack of marketplace success is the fault of defects in the Cable Card order:

> The fact is that consumers have never really had an opportunity to make a choice between retail and leased boxes because retail navigation devices have never been placed on an equal footing with operator-supplied boxes in terms of installation, pricing, and services. Even subscribers who only want to receive a modest package of cable channels must "give up" something in price, convenience, and frustration, including installation and service odysseys. [5]

This claim overstates the case quite substantially. In common experience, buying and installing a third generation Cable Card-enabled PVR is no more arduous than

[5] "Tivo Inc. Comments on Notice Of Inquiry: MB Docket No. 10-91, CS Docket No. 97-80, PP Docket No. 00-67," July 13, 2010.

performing the same activities were for the DirecTivo: the consumer buys the device at a retail outlet, activates the TiVo program guide service, and then places a call to the MVPD for a Cable Card installation. On the appointed date a service technician arrives with multi-stream Cable Card (in some cases, a pair of single stream Cable Cards), installs it in the PVR, records a serial number, and places an activation call to the MVPD. Within minutes from the technician's arrival, service is live on the TiVo and the technician leaves. DirecTivo required a pair of credit-card sized security cards which had to be ordered from DirecTV or an authorized installer. Both the Cable Cards and DirecTV security cards are paired with specific TiVo devices and customer accounts.

Once installed and activated, the PVR with Cable Card operates for years without significant incident. The only service aspect that the user "loses" by having a retail PVR instead of leasing a PVR from the MVPD is the ability to access the MVPD's VoD services, but as the PVR is a VoD device in its own right, this isn't particularly significant. The consumer who wants the MVPD's VoD services has some options, the simplest of which is to lease the MVPD's STB for a modest monthly fee.[6] MVPD VoD programming is already time-shifted and stored on a hard drive, so the PVR doesn't add value to it beyond connection simplicity.

PVRs may provide access to Netflix, Amazon, YouTube, and other content, as noted, that the typical MVPD may not provide. In common experience, the retail PVR has more functional positives than negatives when compared to the low-end PVRs and STBs leased by MVPD's. The most problematic functional aspect of owning a retail PVR today is lack of access to Switched Digital Video programming in certain areas, pending the wider deployment of tru2way, a development that wasn't anticipated by the Cable Card order.

The most burdensome aspect of PVR ownership is the fact of ownership itself. In a rapidly changing technology area, it's often more sensible to lease than to own, especially when the cost of ownership is as high as it is for the retail PVR with its high up-front cost

[6] See a discussion of this on the TiVo Community Forum at http://www.tivocommunity.com/tivo-vb/showthread.php?t=188198.

a continued service fees. As we've seen in the cell phone market, retail smartphones don't do well even when they're fully supported by a range of carriers. Google ended its experiment with the Nexus One, for example, when it became clear that consumers prefer to lease than to purchase such devices, even though the long term lease price may be higher that the purchase price. When consumers are replacing devices every 18 months, as many do with smartphones, there's no incentive to purchase unless the producer offers an attractive upgrade program, which retail PVR manufacturers don't do.

Why the Retail PVR Hasn't Prospered

It's impossible to say with absolute objectivity and certainty why some businesses succeed and others fail, but in the case of the retail PVR, many years of experience point to issues that will not be remedied by the gateway device proposed by the FNPRM or a revised Cable Card order. This is not to say that the gateway device is wholly without merit or that the Cable Card order is perfect, but merely to introduce the common experience of long-time TiVo users into the discussion. This isn't to single out TiVo for criticism as it is to recognize that the retail PVR market is dominated by TiVo, so talking about the retail PVR is talking about TiVo and vice versa.

TiVo is a high-priced product with limited function by design. The current generation devices, the Premiere Series, start at $300 for a unit with 45 hours of HD recording capability. Using the TiVo requires a subscription to the TiVo service for an additional fee:[7]

TIVO SERVICE PLANS

1. At the time of activation of a service plan, you will be required to commit to the TiVo service for a minimum of one (1) year. You can pay for a subscription to the TiVo service on a monthly, annual, or prepaid basis.
2. You may pay for the TiVo service on a monthly basis for one (1) year at $12.95 per month. Promotional Pricing may be available from time-to-time.
3. You may also pay annually for your TiVo service at $129 a year, prepay for three (3) years at $299 (renews annually after 3 years) or purchase a Product

[7] "TiVo Service Payment Plan Terms and Conditions: Updated September 2008," https://www3.tivo.com/abouttivo/policies/tivoservicepaymentplanstermsandconditions.html.

> Lifetime Service (as described below) at $399. Promotional Pricing may be available from time-to-time.

Customers upgrading from an older TiVo product are allowed a modest discount in new equipment: the TiVo Premiere is reduced by $60, but "Product Lifetime Service" is tied to a machine rather than a customer and does not roll forward. The low-end TiVo Premiere is therefore a $700 product ($300 for the device and $399 for Product Lifetime Service) that becomes even more expensive if the customer chooses to pay for the service by the month or by the year. Given that dozens of 40 inch and larger HDTV's are on the market at prices below the TiVo's price[8], the full consumer price of the TiVo clearly inhibits sales. It must find a market niche between low-cost PVRs leased by network operators on the one hand and PC-based PVRs with free program guides such as Myth TV and Windows Media Center on the other.

Cable Card benefits TiVo by protecting it from competition by the PC-based PVR. Cable Card devices can't be "open systems" that allow users to freely copy and redistribute premium content such as HBO programming, so there are no Cable Card adapters for Windows Media Center. A Cable Card order that permitted PC-PVRs access to the same range of content enjoyed by the closed Cable Card TiVo would be unlikely to benefit retail PVRs; it would also have the unfortunate side effect of significantly weakening the intellectual property rights of the producers of television programming.

TiVo suffers from two major technical drawbacks:

1. The TiVo user interface, once rightly viewed as a major advance in ease of use, has failed to keep pace with the advance of technology. It's barely distinguishable today from its initial incarnation in the 1990s, while television has advanced from NTSC to ATSC with higher resolution and superior computer integration.

[8] See an Amazon listing at: http://www.amazon.com/gp/search/ref=sr_nr_p_36_0?bbn=493964&keywords=40+inch+hdtv&sort=pmrank&qid=1280795639&rh=n%3A172282%2Ck%3A40+inch+hdtv%2Cp_36%3A1253507011&rnid=386442011&low-price=200&high-price=700&x=5&y=11.

2. TiVo has been agonizingly slow to implement bug fixes and incremental enhancements, and still relies on expedient solutions to user experience problems that appeared in the first generation.

   One example is the means by which TiVo resolves conflicts between multiple versions of the same program. TiVo allows users to create "Wish Lists" that record programs by keyword. This feature addresses a shortcoming in the "Season Pass" feature that chases a program around in time but only on a given channel. A fan of the Oakland A's baseball team, for example, might create a Wish List for all A's games in order to deal with the fact that these games are broadcast on a number of different channels: Fox, ESPN, Fox Sports California, Fox Sports Bay Area, and MLB TV, all in standard definition on one channel and high definition on another.

   On the rare occasions when the A's are broadcast to the national audience on ESPN, the ESPN broadcast is blacked-out in the Bay Area market, where the game is broadcast on Fox Sports California unless the A's are playing the Giants, in which case the game is either on the local NBC affiliate or on Fox Sports Bay Area. In this scenario, the Wish List chooses among multiple occurrences of the game in the program guide by simply choosing the one with the lowest channel number, which is effectively random selection. If ESPN happens to have a lower number than Fox Sports, which is frequently the case, the TiVo records dead air instead of a baseball game. Dead air is easily distinguishable from a live program stream by software, but TiVo has failed to implement the easy fix for this problem, which would simply be to favor the live channel over the blacked-out channel. Consumers who are asked to pay as much or more for a PVR as for their HDTV expect such problems to be corrected before they become ten-year-old "features" of the TiVo experience.

   The TiVo Community abounds with similar examples, such extra-time padding being falsely treated as a tuner conflict where back-to-back programs on the same

channel are concerned, the fully manual nature of the "Channels I Receive" feature, and many other issues.

Retail PVRs – TiVo in particular – are high-priced devices that don't perform as well as they should. Their software hasn't advanced significantly since inception in terms of ease of use and is still buggy in many areas. They lack many of the features now available for MVPD PVRs, such as iPhone and Android apps, and upgrades are extremely expensive. They're special purpose hardware devices that perform functions that can be done cheaper and better by software running on general purpose PCs.

TiVo seeks FCC regulations limiting the capabilities of MVPD PVRs, the wrong approach to stimulating innovation. If the FCC can only create a retail PVR market by artificially handicapping leased systems that have won dominant favor with consumers, perhaps such a market should not be created. Fortunately, there is an alternative.

An Alternative Video Gateway

The All Vid gateway/adapter device proposed by the FNPRM is a pipeline between the MVPD's programming and the retail PVR. Programming and program guide data flows from the MVPD to the PVR over a standard interface, and tuning requests flow from the PVR through the gateway and on to the MVPD's internal equipment.[9]

[9] *In the Matter of Video Device Competiton*, Notice of Inquiry (Washington, DC: Federal Communications Commission, April 21, 2010), p 19.

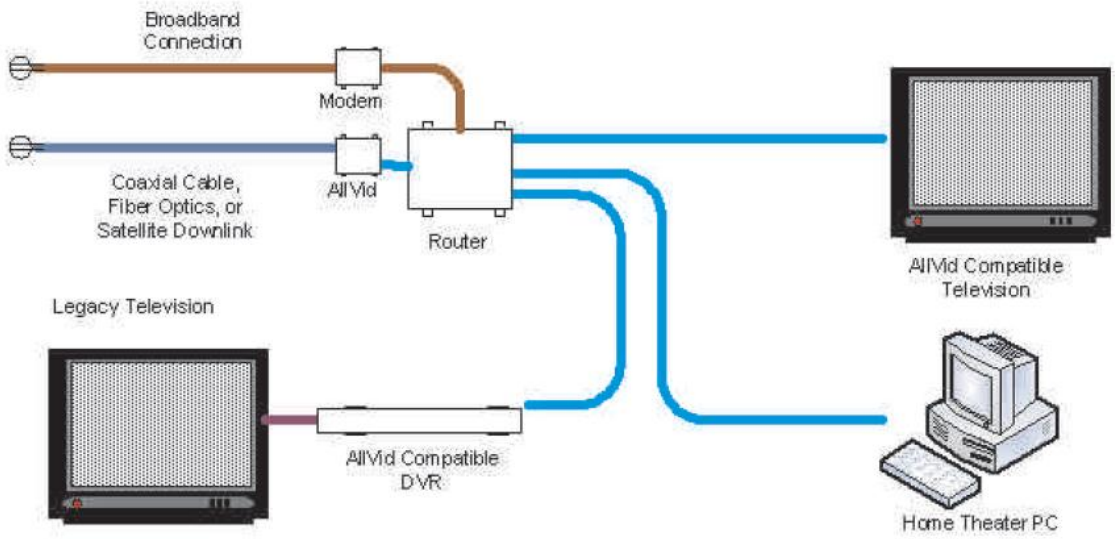

Figure 1: All Vid Concept

In theory, the PVR is supposed to honor content protection, perhaps according to DTCP-IP. Presumably, it would be required to leave commercials intact, but the NOI is silent on this subject. The supposition that DTCP-IP can adequately protect licensed content from capture, duplication, and redistribution in this arrangement however, is not plausible.

The system diagram above shows a "Home Theater PC" in the pipeline. Inside the Home Theater PC (HTPC), video programming is stored in a standard file, where it can be copied, backed-up, and transferred across the user's network or to external media such as a burnable DVD. These are capabilities that only exist in limited form on today's TiVo HD and Premiere, closed devices that are not end-user programmable. TiVo will not transfer premium content across a network or to a DVD burner. While this limitation is irksome to the TiVo user who wants to view HBO and other premium programming on a computer, even within his home, it's not unreasonable given the commercial-free premium business model and the superior nature of premium programming.

A HTPC is actually a general-purpose, end-user-programmable device that happens to be equipped with a television interface such as HDMI and (optionally) a television tuner.

Transferring premium content to a general-purpose PC, even in encrypted form, guarantees that it will be pirated. The example of the DVD illustrates this prediction: the encryptions for both standard DVDs and Blu-ray have been hacked, and a number of for-fee and free software tools are available to unlock DVD and Blu-ray content.[10] Commercial-stripping tools are also widely available.[11] The All Vid concept is an invitation to content piracy and commercial suppression and substitution, but it need not be.

An alternate system for presenting the user with the benefits of the retail PVR implemented either in a closed system such as TiVo HD or in an open system such as the Windows-based HTPC, is possible. In the alternate system, the MVPD would provide the content storage and protection, and would only stream programming to an HDMI-compliant or analog display device as TiVo does today. The retail navigation device, including open HTPCs, would have control over the viewer experience, including browsing, scheduling recordings with Season Passes, and viewing content with "Trick Play" modes supported.[12] The navigation device would also be able to aggregate content from other sources, such as Netflix streaming and other Internet-based content alongside MVPD programming within a common user interface. This device would accelerate the transition from multicast MVPD programming to unicast Internet-based programming without exposing premium content to piracy.

[10] DVDFab.com is the first of three sponsored links that come up when Googling "copy Blu-ray": http://www.dvdfab.com/?gclid=CLXGmvWspqMCFSYRswodJToe3g. There are many others hits, both sponsored and organic.
[11] Removing commercials from source material is easily done with both automated and manual editors. MythTV, a home theater PC software package, provides guidance at http://www.mythtv.org/wiki/Removing_Commercials.
[12] "Trick Play" modes are the VCR-like control functions such as "Pause," "Fast Forward," "Rewind," etc.

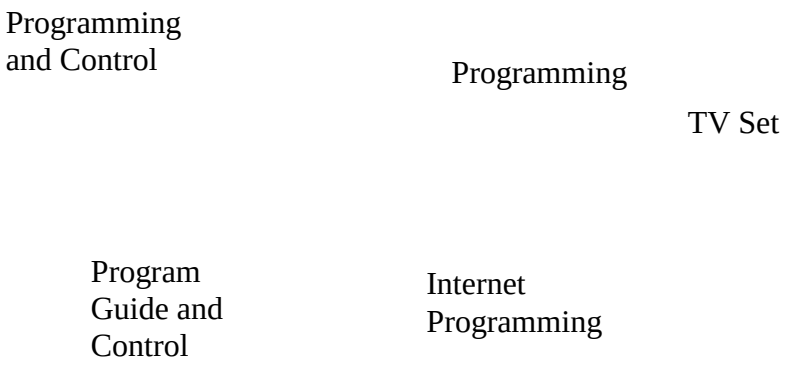

Figure 2: Alternate All Vid Concept

In the Alternate All Vid (AAV) concept, on-demand, switched digital video, and streaming video would flow from the MVPD's internal servers to a premises STB or PVR as they do today, and would only be sent from there to an authorized device, such as TV set in the case of premium programming, or to an arbitrary device of the user's choosing, if that's permissible under the terms of the contracts between the MVPD and the programming producer.

The concept is based on the way that TiVo integrates Netflix and YouTube today, through a separate user control and content acquisition elements than TiVo uses for TV content. The TiVo user interface communicates with Netflix without storing content in the TiVo. The viewer can select movies from the Netflix Watch Instantly list, control their playback with Trick Play, assign ratings to them, and delete them from the list without ever storing a copy on the TiVo's hard drive.

Effectively, the movie streams from the Netflix CDN to the viewing screen with the TiVo simply performing a pass-through function that shares little more a video connection on the TV screen. If this method of interaction is workable for TiVo and Netflix, it should be

workable for an AAV and the future PVRs it enables. Consequently, the AAV interface does not need to transfer content to the retail navigation system, it only needs to transfer descriptions of content such as program guides, lists of locally stored programming, and lists of content available on the MVPD's VoD service to the PVR, and to process command from the PVR relating to the content.

The AAV interface also needs to accept and display user interface elements and programming from the PVR to the user's TV display in order to allow the PVR to integrate programming from the Internet, DVDs, and other sources with MVPD material and to share a common connector to the TV.

The rough information flows are as follows:

1. From AAV to PVR:
    a. Program Guide
    b. List of Locally Stored Content
    c. List of VoD content
2. From PVR to AAV:
    a. Recording commands for live MVPD content
    b. Selection commands for MVPD-supplied content
    c. Trick Play Commands
    d. PVR programming (from outside the MVPD)
    e. User Interface elements for interacting with PVR programming
3. From AAV to TV:
    a. Playback of MVPD programming
    b. MVPD user interface
    c. PVR programming pass-through
    d. PVR user interface

This mode of interaction provides the PVR with access to the full array of MVPD content without running afoul of licensing terms or exposing premium content to piracy. It provides the retail PVR with a free program guide that it can use for scheduled recordings and with full playback ability for its own content. It most of all, it allows the retail PVR

to be a fully open system, perhaps nothing more than software running on a generic PC, which maximizes the opportunities for PVR innovation far beyond the limited horizon of the PVRs of the past decade.

Conclusion

At a very high level of abstraction, the All Vid concept is sound, but a different assignment of functions improves it substantially, reducing cost, protecting premium programming, and freeing the PVR market to open source software implementations. Re-thinking All Vid as the Alternate All Vid only requires us to re-conceptualize the PVR: instead of a storage device with a basic user interface, it becomes a search function for content from various sources, a user interface, and a streaming service, like a local version of Netflix. Rethinking All Vid in this way enhances its consumer utility and better enables the Commission to realize its goals, without the risks and drawbacks that have afflicted the Cable Card regime.